

### If you get heads

\_\_\_ you sat in the front of the blue

van

\_\_\_ you leaned out the window

\_\_\_ you watched from outside the lab

\_\_\_ you drank soda with caffeine

\_\_\_ you got paint on your skin

\_\_\_ you sat in the back of the yellow

bus

### If you get tails

\_\_\_ you sat in the back of the blue

van

\_\_\_ you stayed inside the van

\_\_\_ you sneaked inside the lab

\_\_\_ you drank soda without caffeine

\_\_\_ you painted neatly

\_\_\_ you sat in the front of the yellow

bus

## Heads or Tails?

---

## Choice Cards

---

**CHOICE  
CARD**

**CHOICE  
CARD**

**CHOICE  
CARD**

**CHOICE  
CARD**

**CHOICE  
CARD**

**CHOICE  
CARD**

**CHOICE  
CARD**

**CHOICE  
CARD**

**CHOICE  
CARD**

**CHOICE  
CARD**

# Fact Sheets on Chemicals

---

## Fact Sheet #1

### Chemicals in the Blue Passenger Van

Sometimes, when people are exposed to new products such as carpet or furniture in their homes or new automobiles, they experience a variety of symptoms such as headaches, itchy eyes, and difficulty breathing. Scientists are not always able to determine whether the chemicals emitted by the new products are responsible, but they are aware that chemicals used in building materials can harm humans. When these products are inside small areas, such as rooms in houses, in mobile homes, or in vehicles, the gases they emit can produce an odor.

#### **Formaldehyde**

Formaldehyde is a chemical used in the manufacturing of pressed wood products, as a component of glues and adhesives, and for adding permanent-press qualities to fabrics. Formaldehyde is released as gas into the air from new products that are made with it, such as carpet, carpet adhesives, fabrics, and plywood. This “outgassing” is greatest when the product is new and gradually decreases as the product ages until it no longer occurs. High heat and humidity increase the rate at which formaldehyde is released and shorten the time during which the odor of formaldehyde gas is noticeable.

A person exposed to high levels of formaldehyde in the air can have watery eyes, burning sensations in the eyes and throat, nausea, and difficulty breathing. High concentrations sometimes trigger attacks in people with asthma. New products made for homes, autos, and buses do not release high levels of formaldehyde.

To minimize exposure to formaldehyde, people can ventilate areas that contain new products that emit formaldehyde. They can choose to use wood products that are not pressed wood but should weigh their worry about formaldehyde against the fact that the use of pressed wood conserves more natural resources. They can request low-emitting adhesives for carpets.

The blue van, although new to the students, was built four years ago with materials containing chemicals, including formaldehyde. The van previously was owned by a touring company in Florida and was bought by the school district in August of the current year.

## **Fact Sheet #2**

### **Chemicals at the Gas Station**

#### ***Benzene in Gasoline***

Gasoline is a mixture of chemicals, including benzene. Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly when you pump gas into your car or when gasoline is accidentally spilled onto surfaces at a gas station. The concentration of benzene in gasoline is low.

Outdoor air contains low levels of benzene from tobacco smoke, gas stations, exhaust from motor vehicles, and industrial emissions. The air around gas stations contains slightly higher levels of benzene than air in other places.

Breathing benzene vapor in small amounts occasionally causes headache, euphoria (a “high”), a light-headed feeling, dizziness, drowsiness, or nausea. Higher levels of benzene exposure can result in drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Fifteen to 20 breaths of concentrated gasoline vapor can produce a response for five to six hours, ranging from dizziness and confusion to restlessness and hallucinations. Very high doses of benzene can result in death.

Benzene vapors are mildly irritating to the skin, eyes, and lungs. If liquid benzene splashes into the eyes or onto the skin, it can cause burning pain and damage the cornea of the eyes.

No long-term effects are likely from a single, small exposure to benzene. Repeated small exposures (for more than 365 days) can cause blood disorders and cancer of blood-forming cells. Benzene can cause harmful effects in bone marrow and a decrease in red blood cells, leading to anemia. It also can cause excessive bleeding and affect the immune system, increasing the chance for infection.

Many states require gas stations to install vapor-return barriers that cover gas pump nozzles. These barriers help prevent air pollution from gasoline fumes and protect people who are pumping gas from gasoline fumes. In addition, overflow shut-off valves help keep people from accidentally spilling gasoline onto the ground.

The Environmental Protection Agency’s annual inspection of the gas station where the school van stopped for gas indicated that the overflow shut-off valve on the gas pump needed adjusting and people using it often spilled a small amount of gasoline.

### **Fact Sheet #3**

#### **Chemicals in the Paleontology Lab**

In the paleontology lab, scientists, artists, and technicians work to create models of dinosaurs and their environments out of plaster, fiber glass, plywood, and fiberboard.

##### ***Fiber Glass***

Fine particles in the air can cause health problems. In areas where materials are cut, ground, or sanded, the particulate matter that becomes airborne is a source of air pollution. The health effects of breathing in the particles can include eye, nose, and throat irritation; respiratory infections and bronchitis; and lung cancer.

The use of fiber glass in building materials creates fiber glass dust, fine glass fibers that can be breathed into the lungs. Manufacturers of materials made with fiber glass suggest that people working with the material, like those in the paleontology lab, use a mask over their nose and mouth to protect themselves from airborne glass fibers. The Occupational Safety and Health Administration's report on the paleontology lab states that the work place complies with regulations; the level of particles in the air requires that scientists in the lab wear respirators, which they do.

##### ***Formaldehyde***

Pressed-wood board is made with adhesives that contain urea-formaldehyde resins. Some examples of pressed board that are commonly used as building materials are particle board, plywood, and fiberboard. The higher the resin-to-wood ratio, the more formaldehyde there is in the product.

Pressed-wood products emit formaldehyde gas, and the air in rooms where pressed-wood products are used can have elevated levels of formaldehyde. If the heat and humidity are high in a room, the emission of formaldehyde can increase. As the product made with formaldehyde ages, the emissions of formaldehyde decrease until they are no longer measurable.

Most people will notice the pungent odor of formaldehyde if they are exposed to it. They will experience a burning sensation in their eyes, nose, and throat when they breathe the gas, even in small amounts for short periods of time. Breathing in the gas over a longer time or at higher doses can cause coughing or choking. Very high exposures can cause death from throat swelling or from chemical burns to the lungs. People working for long periods of time in areas with formaldehyde gas wear respirators or work in a room with good ventilation.

People are surrounded by pressed-wood products in their everyday life. The use of pressed-wood products in the paleontology lab does not pose an increased health hazard to the workers. Because they use respirators, the workers' exposure to formaldehyde is minimal.

## **Fact Sheet #4**

### **Chemicals at Lunch**

#### ***Caffeine***

Caffeine is a naturally occurring substance found in the leaves, seeds, or fruits of more than 60 plants. Coffee and cocoa beans, kola nuts, and tea leaves contain caffeine and are used to make beverages such as coffee, tea, cola drinks, and chocolate.

The U.S. Food and Drug Administration and the American Medical Association have conducted extensive research into the health aspects of caffeine. They agree that moderate consumption of tea, coffee, and other caffeinated drinks does not cause health problems. Moderate caffeine consumption is defined as about 300 milligrams a day, which is equal to three cups of coffee or between four and eight cans of a caffeinated soft drink.

People differ greatly in their sensitivity to caffeine. Some people can drink many cups of coffee, tea, or soft drinks a day and feel no effect, while others feel stimulating effects after one cup. When trying to lessen their intake of caffeine, some sensitive individuals might experience mild, temporary symptoms of withdrawal, including headaches, restlessness, and irritability.

Caffeine can increase alertness in tired individuals and help people stay alert when they work or study. There is no difference in the way children and adults handle caffeine, and caffeinated beverages do not affect hyperactivity or the attention span of children.

Caffeine can cause a temporary rise in blood pressure, less than that normally experienced when climbing stairs and not lasting more than several hours. However, individuals with high blood pressure should consult their physicians about caffeine consumption.

The students on the field trip each brought their own lunch. As a treat, the teachers brought soft drinks for the students. Some of the soft drinks contained caffeine, some did not.

## **Fact Sheet #5**

### **Chemicals in the Art Room**

#### ***Solvents***

Solvents are substances that dissolve other substances. Water is one example of a solvent. Some solvents smell like kerosene and are used as paint thinner and cleaner. The chemicals that make up some solvents can be harmful to human health.

Exposure to the harmful chemicals occurs when people use products such as paint thinner and breathe the vapors or get the vapors in their eyes. Exposure to these substances can affect the nervous system and cause dizziness, headache, or a prolonged reaction time. Exposure also can cause eye, skin, or throat irritation.

Children attending school and participating in arts and crafts might use art supplies that contain small amounts of solvents, such as rubber cement, permanent felt tip markers, pottery glazes, enamels, and spray fixatives.

The use of glue-containing solvents in a small room with no fresh air can cause headaches, which can signal central nervous system problems. Large doses, such as those experienced during intentional glue sniffing, can cause loss of coordination, nausea, and even death.

Chronic exposure in poorly ventilated areas to hobby materials containing solvents can result in chronic health effects that are hard to trace to their cause. These include skin disease, liver damage, and nervous system damage.

Most schools use only nonhazardous art materials. The selection of materials is based on fulfilling the following conditions:

- no dust or powders;
- no harmful solvents or solvent-containing products;
- no aerosol spray cans or air brushes;
- nothing that stains the skin or cannot be washed out of clothing;
- no acids, alkalis, bleaches, or other corrosive chemicals;
- no lead, cadmium, or other metal products (these can be found in glazes, metal work, and stained-glass products)
- no donated or found materials, unless ingredients are known;
- no old materials purchased before 1990 (when the new labeling standard of the American Society of Testing and Materials (ASTM) became effective);
- only use products that meet the ASTM standard and are labeled “conforms to ASTM D-4236.”

[Source: Environmental and Occupational Health Sciences Institute. 1997. *Infosheet: Children's Art Supplies*. ]

The dinosaur model painting the students did used tempera paint, which is a brilliant, opaque, nontoxic watercolor. Its solvent is water; it can be thinned with water and cleans up with water. The coloring agents in the paint are nontoxic.

## **Fact Sheet #6**

### **Chemicals in the Yellow Bus**

#### ***Carbon Monoxide***

Carbon monoxide is an odorless, colorless, poisonous gas released from the incomplete burning of fossil fuels, such as gasoline, propane, natural gas, oil, wood, and coal. Burning tobacco also produces carbon monoxide, one of the gases in cigarette smoke.

When people breathe in carbon monoxide, the carbon monoxide molecules compete with oxygen molecules for the same binding sites on hemoglobin. The hemoglobin molecule cannot tell the difference between carbon monoxide and oxygen, so it carries carbon monoxide in the blood instead of oxygen. When tissues become starved of oxygen, people begin to experience fatigue. As the concentration of carbon monoxide increases, people experience headaches, weakness, nausea, dizziness, dim vision, and changes in heart rhythm. If carbon monoxide is present at very high concentrations, it can lead to unconsciousness, coma, convulsions, and death. According to the Mayo Clinic, approximately 10,000 people are poisoned by carbon monoxide in the United States each year. Fetuses, infants, elderly people, and people with anemia or a history of heart or respiratory disease are especially sensitive to carbon monoxide exposures.

About two-thirds of all deaths from carbon monoxide poisoning occur in cars. Automobile exhaust contains up to 9 percent carbon monoxide, although catalytic converters substantially reduce carbon monoxide levels to below 1 percent. Because of lack of ventilation, automobile exhaust can leak into the car and slowly overcome the passengers.

People can reduce their exposure to carbon monoxide. They can use carbon monoxide detectors to warn them of any carbon monoxide in their home or workplace. They can keep gas appliances in their homes properly adjusted. They can install and use vents and exhaust fans for their gas stoves, space heaters, and fireplaces. They can make sure that their furnaces are working properly and are not leaking. They can make sure they never idle their car in the garage or breathe the fumes from other idling vehicles. Finally, they can keep their automobile in good condition, paying particular attention to the exhaust system. A state vehicle emissions report made the day after the field trip indicated that the yellow bus the students rode home in from the field trip had a faulty exhaust system.